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ABSTRACT

An external summative evaluation was conducted for the Self-Directed Workplace Distance Learning for Developmental Disabilities Workers Project, a partnership between the Center for Advanced Study of Education and the Civil Service Employees Association, Inc., with the New York State Office of Mental Retardation and Developmental Disabilities. Its goals were to document changes in literacy skills and other relevant variables over the course of training and to link them to the training intervention. The original research design called for a nonequivalent control groups design in which a distance learning group would be compared to a control group of workers on the waiting list for program participation. Since nearly all control group individuals were in the first cycle of the program, only changes in participants' literacy skills were evaluated---not whether change resulted from participation. Furthermore, large numbers of participants failed to have complete data on both pre- and posttest measures. Data were collected by background and pre- and posttest measures, including reading test, writing test, problem-solving test, self-efficacy test, and supervisor ratings. As indicated by the three literacy measures of reading, writing, and problem solving, some gain in performance on writing and problem solving but no positive gains in reading performance were found. Both supervisors and participants felt employees benefited from participation in the distance learning program. (YLB)

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FINAL EVALUATION REPORT ON THE DISTANCE LEARNING PROJECT

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2

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Roger E. Millsap, Ph.D.

Center for Advanced Study in Education
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of the City University of New York

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This is an external summative evaluation report for the Self-Directed Workplace Distance Learning for Developmental Disabilities Workers Project, a partnership between The Center for Advanced Study of Education (CASE) of the City University of New York Graduate School and the Civil Service Employees Association, Inc. (CSEA), with the New York State Office of Mental Retardation and Developmental Disabilities (OMRDD) and the Government Office of Employee Relations (GOER) as helping organizations. The goals of the research component of the Distance-Learning Project were twofold. First, we wished to document changes in literacy skills and other relevant variables over the course of training. Second, we wished to link these changes to the training intervention. The purpose of this report is to present data and interpretations relevant to the achievement of these goals, and to draw conclusions where possible. An evaluation plan was created in the planning stages of the project. Many of the planned evaluation analyses were ultimately done, although as will be noted below, some aspects of the evaluation have been altered to accomodate changes in the project.

The report will begin with a brief description of the research design and the measures used in the study. Results of the various analyses that examined changes in literacy skills and other measures will then be presented. The final section offers some conclusions based on these analyses.

Research Design

The original research design called for a nonequivalent control groups design in which a distance learning group (the "treatment"group) would be compared to a control group of workers who had been wait-listed for participation in the distance learning program. Assignment to control versus learning groups would not be controlled by the researchers, and hence the groups would not be regarded as equivalent prior to the start of the program. Both pretest and postttest measures of literacy skills would be collected within each group. These measures are further described below, along with other measures used in the study. The outcome of the program was to be evaluated by comparing the change from pretest to posttest in the literacy skills measures between groups, using either direct comparisons of average change scores or the analysis of covariance with the pretest scores as covariates. This design was to be essentially replicated across multiple cycles of the program with different sets of workers. The final evaluation could aggregate data across cycles, or disaggregate if different results were expected as a function of cycle.

The actual implementation of the study did not follow this plan after the first or second cycle of the project because of the difficulty in obtaining control group individuals. Nearly all of the control group individuals were in the first cycle of the program. Subsequent cycles either had no provisions for a control group, or did not have sufficient control group members with both pretest and posttest scores to permit group comparisons. By the end of the four cycles, the number of control group individuals with both pretest and posttest data was fewer than 10 on all of the major literacy outcome variables. Given the lack of a control group, we can evaluate changes in literacy skills for the participants following participation in the distance learning

program, but we cannot determine whether this change resulted from participation.

A second difficulty in the actual implementation of the program was that large numbers of participants failed to have complete data on both the pretest and the posttest measures. Among the 253 participants for whom we have some data, fewer than 70 have both pretest and posttest data on any of the major literacy measures. The exact number of participants with both sets of data varies depending on the measure in question. The most frequent omission is the posttest data, although 102 participants are missing pretest data (90 of these are missing posttest data as well). The reasons for the missing data are unclear in most cases. The original plan in the event that an individual dropped out of the program was to collect information on the individual's reasons for leaving. We were able to obtain dropout information on 40 participants who left the program. For the remaining participants who are missing data, the reasons for the missing data are unclear. Without both pretest and posttest scores on a given measure, it becomes impossible to evaluate changes in skills that might result from participation in the program. Fortunately, enough of the participants had complete data on the literacy skills measures to permit some evaluation of change.

In addition to the main portion of the design, a secondary, smaller component of the design was included to look at longer-term changes in literacy skills that might result from participation in the distance-learning program. During the final three months of the study period, 12 participants who received training during the first year of training were again interviewed regarding job performance and career advancement. These 12 individuals will be selected to have adequate variability on the pretest measures: four individuals were selected from the highest performing group on the pretest, four were selected from the average group on the pretest, and

four were selected from a low performance group. The data obtained from these participants will be denoted the "longitudinal data" in what follows. Although the total group size is too small for tests of statistical significance to have adequate power, some descriptive results for the group will be reported below.

Measures

Background Measures

Background information was recorded for each individual that entered the project. This information includes the individual's age, gender, marital status, number of dependents, job title, job location, job tenure, whether full or part-time, the language used in childhood, the language used most often now, the highest grade completed in school, whether the individual has had any non-credit courses in reading or writing, or any other training that the individual has received. All of this information was gathered when the participant first entered the project, for both treatment and control individuals.

Pretest and Posttest Measures.

Pretest literacy measures were given to both treatment and control individuals during their initial entrance into the program. Posttest literacy measures were given at the end of the six month training period. The time required for either set of measures to be completed by a participant was about 1 1/2-2 hours.

All literacy measures in this evaluation were customized to the job, and were locally developed. Each participant completed a test of reading comprehension at pretest and posttest, denoted the "Reading Test" in what follows. Examinees were given three reading selections, with each selection followed by a set of multiple-choice questions that refer to the selection. The

reading selections contain job-related material similar to that encountered on the job. A total of 10 multiple-choice questions were given. Each examinee was given 20 minutes to complete the test. The examinee's score is calculated as an unweighted total across these 10 questions and then expressed as a percentage of the number of points possible.

The next test was a direct writing assessment measure, denoted the "Writing Test" here. In this test, examinees were asked to write a description of their job as if they were describing the job to a coworker. Each examinee was given 20 minutes to write the essay. The essays were scored by two trained readers. The scoring system is an analytic system that rates the essay on five dimensions: content, organization, vocabulary, language use, and mechanics. Each dimension is scored on a four-point scale ranging from "very poor" to "excellent to very good". The total number of points given for each essay therefore ranges from 5 to 20. The two readers were instructed to rate an essay independently, and then to reach consensus if their ratings differ. If a consensus cannot be reached, a third reader read the essay. The final score for the essay is an average of the three reader's ratings, again expressed as a percentage of the total possible points.

Each participant also completed a test of problem-solving skills, denoted the "Problem-Solving Test" here. In this test, the examinee was presented with a series of job-related scenarios. Each scenario consists of a problem situation typical of those that might be encountered on the job. The examinee must write a paragraph describing what he or she feels is the best way of resolving the problem. Four scenarios are presented in the test, and each requires a separate written response. The written responses were scored by readers who have been trained for this scoring task. "Best case" solutions to each scenario (and the scenarios themselves) were developed in collaboration with present and former staff members of the New York State Office

of Mental Retardation and Developmental Disabilities (OMRDD). The response to each scenario was scored on a four-point scale to indicate its similarity to the best case solution. Total scores across the four scenarios range from 4 to 16 points. The final score for an individual was expressed as a percentage of the total possible score.

The final measure used in the pretest and posttest was a self-efficacy scale that concerns job-related competencies. This measure will be denoted the "Self-Efficacy Scale" here. In this scale, the examinee was presented with five work situations in which a general task is to be completed. Within each situation, the examinee was asked about the degree to which he or she is sure that various activities could be successfully completed. All of the activities concern different subtasks that must be performed in the situation. These subtasks involve the three different basic literacy skills of reading, writing, and math. The examinee responded to each question on a seven-point scale ranging from "Not at all sure" to "Very sure". A total of 18 questions were asked across the five situations. Total scores were calculated as sums of item scores across all five situations, and subtest scores were calculated to correspond to specific literacy skills (reading, writing, and math). All scores were expressed as percentages of the total number of possible points on a given scale.

In addition to the measures to be completed by the participants, the supervisor of each participant was asked to complete some ratings of the participant at both pretest and posttest. These ratings were collected on the same time schedule as the other pretest and posttest measures. The ratings consist of 12 questions regarding how well the participant is able to complete various job tasks. The tasks involve basic reading, writing, and arithmetic skills. Ratings are given on a four-point scale, with an additional rating category for "not applicable" to

be used if the participant never does the task in question. These pretest and posttest ratings will be denoted the "Supervisor Ratings" in what follows.

Along with the Supervisor Ratings, each participant was asked to rate his or her own task completion using the same set of 12 job tasks that were rated by their supervisor. The response scale is the same as that used by their supervisor. At posttest, the participant was also asked to rate the amount of improvement on the same four skills rated by their supervisor. These participant self-ratings will be denoted the "Participant Ratings" in what follows.

Results

Demographic characteristics

The sample is mostly female (83%), with ages ranging from a low of 23 to a high of 68. The median age is 39. Almost 80% of the sample were born in the United States, and nearly all speak English (96%) as the language spoken most often in the home. The racial status of the participants was assessed with two questions, one asking whether the participant is Hispanic, and another asking the participant to chose among the categories White, Black (African-American), Asian or Pacific Islander, American Indian or Alaskan Native, and Other. Some participants did not respond to either question, but based on the non-missing responses, the racial breakdown of the sample is as follows: 70 White, 118 Black, 8 Hispanic, 2 Hispanic/White, 5 Hispanic/Black, 1 Indian/Hispanic, 1 Asian, 2 Indian, and 6 Other.

The median number of years that the participants have worked at their current job is 8 years, with the number of years ranging from less than one year to a maximum of 32 years. On average, the participants work 39 hours per week. The participants varied in their job titles, but four titles accounted for the majority of workers: Developmental Aide (84%), Food Service

Worker (8%), Resident Supervisor (3%), and Cleaner (3%).

Among those participants who said that they had received education in the United States (N=199), 75% received 12 or more years of education. There were 30 participants who indicated that at least part of their education was obtained from foreign schools. Of these 30 participants, 22 received 12 or more years of education from foreign schools. Participants were also asked about their training outside of regular high school coursework. There were more missing data for these questions than for the earlier questions about education, but the percentages of participants who endorsed each educational alternative, as percentages of the number of participants who responded, were as follows: College courses for credit (61%), Vocational courses (42%), GED/High school equivalency (31%), Adult basic education or literacy (12%), and Work-related training (86%). Clearly, there are a fair number of participants who have sought to supplement their education by alternative routes.

The participants were asked to indicate the types of skills that are needed on the job from a list of such skills. The following are the percentages of participants who endorsed each skill: Read Instructions (98%), Receive spoken instructions in English (99%), Speak English (100%), Work as part of a team (99%), Write in English (99%), Use math (74%), Solve problems/use reasoning (98%). Apart from the use of math, it appears that nearly all of the participants feel that all of the skills are relevant to the job. The participants were also asked to rate their ability to perform various activities, using a four-point scale from "Poor" to "Excellent". The following are the activities and the percentages of participants who rate their ability as either "Good" or "Excellent": Read English (86%), Understand English (92%), Speak English (90%), Write in English (76%), Work as part of a team (94%), Use math (63%), and Solve problems/use

reasoning (77%). Although writing in English and solving problems are nearly universally regarded as necessary for the job, almost a quarter of the sample feel that their own ability in these areas is either "Poor" or only "Fair". A good portion of the sample also appear to have doubts about their ability to use math, though this activity is less necessary for the job.

Participants were asked about what they would like to get out of the Distance Learning course, from among a list of possible goals. All of these goals are endorsed by over half the participants: Communicate better on your job (89%), Improve communication for everyday life (91%), Help a child or children with homework (76%), Go on to further studies (87%), and Develop your career (92%). The participants were also asked to indicate any possible barriers to their success in the Distance Learning program. About 63% of the participants indicate that they perceived no barriers to success. Another 29% of the participants feel that "time" is a potential barrier, as in "released time" or "time to practice". A variety of other barriers are listed by other participants, such as "child care", but the numbers of participants here is small.

Results for outcome measures

All participants were given a battery of tests in reading, writing, and problem-solving before beginning the program, and at the end of their participation in the program, as mentioned earlier. The two administrations will be denoted the "pretest" and "posttest", respectively, in what follows. The score of interest in each case is the percentage of points achieved by the participant out of the total number of possible points for the test. Our interest lies in the change in the score from pretest to postest. In addition to these test scores, participant self-ratings and supervisor ratings were collected at both pretest and posttest, each expressed as a percentage. Finally, participant self-efficacy measures were taken at both pretest and posttest for reading,

writing, and math. These are also expressed as percentages. Changes in the ratings and self-efficacy measures were examined for those participants having data at both pretest and posttest. A substantial number of participants were missing data either at pretest or at posttest on all measures and test scores however, as mentioned above. Any analyses of change scores were based on those participants who had complete data for the test being examined.

Reliability. A number of the measures of interest had multiple items, permitting an evaluation of internal consistency reliability (alpha coefficients) at the pretest and posttest measurements. The following are the results of these analyses. The results are based on the maximum number of participants who had data on each measure at a given time period. This involved from 146 to 151 participants at pretest, depending on the measure, and 76-77 participants at posttest:

Test	Alpha at pretest	Alpha at posttest
Writing	.88	.87
Problem-solving	.89	.80
Self-Eff Reading	.88	.93
Self-Eff Writing	.88	.91
Self-Eff Math	.68	.65
Total Self-Eff	.93	.95

The Self-Efficacy in Math scales had substantially lower alpha values than the other scales, but the Math scales had fewer items (three) than any of the other scales. The alpha values are generally acceptable.

Pre-Post changes. The following are the sample sizes, means, standard deviations, and t-values for the post-pre change scores on the three subject tests:

Test	N	Mean	SD	t-value
Problem-solving	64	6.06	25.73	1.88
Reading	63	-2.90	19.85	-1.16
Writing	61	1.15	13.88	.64

Note that the scores are expressed as percentages, so that the change scores are changes in percentages. Scores on problem-solving and writing showed an increase on average between pretest and posttest. The change in writing scores did not approach statistical significance, but the change in problem-solving scores was nearly significant at the .05 level. The reading scores did not show an increase on average from pretest to posttest.

The above statistics were recalculated for participants in cycles 2, 3, and 4, omitting the cycle 1 participants. The purpose here was to see if better results were forthcoming in the later cycles when some of the inevitable difficulties facing the start of a project of this scope would have been eliminated. The following results were obtained for the three literacy measures:

Test	N	Mean	SD	t-value
Problem-solving	34	7.35	30.08	1.42
Reading	33	-5.30	23.38	-1.30
Writing	32	4.66	15.13	1.74

These results parallel those obtained with the full sample that included cycle 1. The average changes are larger, but are still negative for the Reading test. Note that the t-values are not larger however, partly due to the smaller sample in these analyses.

On the self-efficacy measures, the following are the sample sizes, means, standard deviations, and t-values for the change scores on each of the subject-specific measures and a total self-efficacy measure:

Measure	N	Mean	SD	t-value
Reading	65	6.15	14.32	3.46
Writing	65	6.78	13.70	3.99
Math	65	5.83	20.11	2.34
Total SE	65	5.60	12.92	3.50

The total self-efficacy measure is a composite of the reading, writing, and math self-efficacy scores. Each of the self-efficacy measures shows a statistically significant increase from pretest to posttest. These results indicate that the participants' feelings of self-efficacy increased in each of the subject areas after participation in the distance learning program.

Similar results were found for the changes in the participant self-ratings and the supervisor ratings. Here are the descriptive statistics:

Measure	N	Mean	SD	t-value
Participant	57	4.95	14.28	2.62
Supervisor	42	8.29	17.04	3.15

The participants showed statistically signficant gains on both of these rating measures. The gains on the supervisor ratings were especially useful, as these are based on raters who are not either teachers or learners.

For reference purposes, the following table gives the pretest and posttest means on all of the above outcome measures for participants with complete data on each measure (for all cycles

combined--the sample sizes are given above), along with the correlation between the pretest and posttest scores:

Measure	Pretest	Posttest	Correlation
Reading	87.35	84.44	.297
Writing	70.90	72.05	.625
Prob-solving	63.02	69.08	.211
Partic rating	76.37	81.32	.330
Superv rating	75.88	84.17	.483
Reading Self eff	72.74	78.89	.563
Writing Self eff	70.23	77.02	.550
Math Self-eff	73.31	79.14	.358
Total Self-eff	72.37	77.97	.542

In addition to the test scores, the participant's instructor provided information on the number of contact hours, the number of email contacts, the number of regular mail contacts, and the number of units completed for each participant. These four variables provide information about the amount of work completed by the participant, as well as the extent of contact between each participant and the instructor. The variables will be denoted the "contact variables" in what follows. Scores on the contact variables were available for nearly all participants. Correlations between scores on the contact variables and the change scores for the above three tests were calculated in order to evaluate whether the contact variables might moderate the test performance change. No statistically signficant correlations were found between the two sets of variables. The correlations were:

	Problem-solving	Reading	Writing
Contact hours	.155	-.052	-.131
Email	-.026	-.171	-.021
Hmail	.062	-.026	.023
Units	.035	-.059	-.049

There does not appear to be any systematic relationship between the contact variables and the changes in test performance. It is possible that more contact time was spent with students who were having difficulties, and that the greater time spent with these students did not directly translate into greater gains in test performance.

In addition to the contact variables, the instructor's rated each participant on the degree of "improvement" shown by the participant in six areas, along with an overall rating. Ratings were on a four-point scale, ranging from 1=No improvement to 4=A lot of improvement. The sample sizes, means, and standard deviations for the ratings were as follows:

Rating name	N	Mean	SD
Understand technical vocab	146	2.34	1.09
Reading comprehension	146	2.35	1.13
Spelling	148	2.20	1.06
Relaying accurate info in writing	146	2.36	1.09
Using basic math	113	2.07	1.05
Oral communication skills	153	2.41	1.17
Overall improvement	151	2.36	1.10

For all ratings, the average rating fell between 2 ("some improvement") and 3 ("good improvement"). The ratings were correlated with the change scores on the three tests. No statistically significant correlations were found, even between corresponding variables (e.g., Reading score and rating on reading comprehension). The largest correlation found was between the rating on "using basic math" and the change in problem-solving score: the correlation was .189. It appears that the instructor's impressions of the improvements in the participant's skills did not agree with the change in test scores. It should be noted that the ratings themselves did not reveal much discrimination among the seven different rating variables. The intercorrelations among the seven ratings ranged from a low of .73 to a high of .91. All correlations were statistically significant. The most likely explanation for this pattern is that the instructor's ratings were influenced by a general halo effect.

Results for longitudinal data.

The longitudinal data involved 12 study participants, divided into three groups (low, medium, high) based on their pretest performance. Four participants were interviewed in each of the three groups. The results of the analyses of these data are reported here.

The 12 participants are all females, with the ethnic distribution being 6 Black, 3 White, 1 Hispanic, 1 Indian, and 1 Other. The participants span five job categories: 7 Developmental Aides, 2 Food Service Workers, 1 Food Service supervisor, 1 Cleaner, and 1 Keyboard Specialist. Eleven of the 12 participants indicated that they are in the same job that they began with. The one individual who is in a different job did not respond when asked about her current job title. Five of the participants indicated that their responsibilities have changed, but only two of these persons described how the responsibilities had changed. Both indicated that they "work more

independently."

Three of the 12 participants indicated that they are enrolled in school, two in college courses and one in computer classes. Eight of the participants said that their career goals have changed. When the 12 participants were asked about their goals before the Distance Learning Program, only five responses were given. Three participants said that they were "not sure; just working", one participant "wanted to be a DA", and one person "didn't think she could go to school." It appears that these 12 participants did not have clear goals prior to Program. When asked about current career goals, the responses were more frequent and varied. The most popular reponses were "retire" (2 persons) and "college" (2 persons). All of the other 11 categories of response received one response, except option 9 (GED), which no respondent included as a goal.

When asked about the effect of the Distance Learning Program on the ability to do the job, the most popular response was "writing, writing better, more accurate" (6 persons). Other popular responses were: communicate better with other workers (3 persons), clarified roles and responsibilites of DA (3 persons), communicate better with parents (2 persons), and communicate better with clients (2 persons). Finally, when asked for other comments about the program, seven participants said that it was a "good program; enjoyed program" and six persons said that they had "good communication/rapport with instructors/advisors." Three persons expressed some problem with the program. One person would like to take Part 2 of the program, and one person indicated that she is "more confident."

The change scores for the 12 participants on the tests given at pre and posttest were examined. The sample is too small for formal significance tests, but we can note whether the

majority of the individuals showed gains in scores. We do not have complete data on all 12 participants. The numbers of participants with both pre and post scores ranged from a low of six (participant rating) to a high of eight (writing, total self-efficacy, problem-solving). We have nearly complete data for the "high" participant group, and fairly complete data for the "low" group. Data are scarce on the "medium" group. For those with complete data, the average change was positive on three of the outcome measures: supervisor rating, writing, and problem-solving. All other measures, including the self-efficacy measures, showed negative changes from pre to post.

Conclusion

The results of the data analyses do not lead to unequivocal conclusions about the effects of participation in the Distance Learning Program, but they are suggestive. As indicated by the three literacy measures of Reading, Writing, and Problem-solving, there was evidence of some gain in performance on Writing and Problem-Solving, although the gain did not reach statistical significance. Surprisingly, there was no evidence of positive gains in reading performance. In fact, scores on this measure decreased from pretest to posttest on average. It is unclear whether this result indicates some difficulty with the measure itself, or whether the instruction in reading was simply unsucessful in creating better performance. The Reading measure's reliability is unknown, as it is not a multi-item measure and no reliability is available for the scoring of the measure. The participants' feelings of self-efficacy in reading did increase following participation in the program. One possible explanation for the Reading result is that the pretest score levels on Reading were higher than on the other literacy measures, and so there may have been a ceiling effect that prevented dramatic gains in performance.

In an effort to see whether measures of program activity were associated with changes in literacy skills, we correlated measures of number of contact hours, amount of email and regular mail, and number of units completed with the change scores on the three literacy measures. No meaningful correlations were found. This result seems to indicate that the explanations for the results on the changes in literacy skills are not to be found in the participant's activity levels.

We solicited ratings from the instructors on the improvement shown among participants following participation in the program. These ratings indicated that, on average, at least some improvement was shown in all of the skills that were rated. The ratings do not show meaningful correlations with the gains in the three literacy test scores however. It is unclear whether the ratings themselves were sufficiently discriminating among the various performance dimensions. The minimum correlation between any pair of rated dimensions was .73, and many correlations ranged above .90. We can conclude from these ratings that the instructors believed that the average participant benefited from participation in the program. Finer conclusions regarding differences in improvement between specific dimensions are probably not warranted, given the general halo found in the ratings.

Clear evidence of gains in participants' feelings of competence and self-efficacy were found, as statistically significant gains in all three of the self-efficacy measures were present. It seems that regardless of the actual increase in skill levels, the participants felt more capable following participation in the program. These results are consistent with the participants' self-ratings and the ratings of the participants' supervisors, both of which showed significant gains from pretest to posttest. It appears that the supervisors felt that the employees did benefit from participation in the distance learning program.

The longitudinal data provide a more qualitative assessment of the program, as the number of participants involved in this phase of the design was small (12 participants). These individuals reported that their writing skills improved as a result of participation in the program. This report is consistent with the literacy test data for these participants, as the average gain was positive on the writing measure. More generally, these participants felt that their communication skills improved also. The majority of the 12 participants felt that the Distance Learning Program was a positive experience.

The original research design, had it been executed, would have permitted firmer conclusions about the impact of the program by including a control group for comparison purposes. In spite of the omission of the control group, there is some evidence that the participants in the Distance Learning Program benefitted from their participation, either in terms of increased skills, or in terms of increased confidence and feelings of self-efficacy.